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PROGRAM DOCUMENTATION
FOR
ELAPSED TIME TO OXYGEN AND HYDROGEN
CAUTION AND WARNING SYSTEM
FOR CAPTIVE/ACTIVE 1 AND 3 FLIGHTS
CPD 710

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ELAPSED TIME TO OXYGEN AND HYDROGEN CAUTION
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National Aeronautics and Space Administration
LYNDON B. JOHNSON SPACE CENTER

Houston, Texas
April 1977



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PROGRAM DOCUMENTATION
FOR
ELAPSED TIME TO OXYGEN AND HYDROGEN
CAUTION AND WARNING SYSTEM
FOR CAPTIVE/ACTIVE 1 AND 3 FLIGHTS

Job Order 81-147
CPD 710

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1. INTRODUCTION

This memorandum provides the results for special High Pressure Gas Storage (HPGS) simulation runs that were made to compute the elapsed time from T-0 disconnect (transfer to onboard reactant) to the caution and warning pressures for the primary oxygen (O_2) and hydrogen (H_2) systems of Orbiter Vehicle (OV) 101. The simulation runs were made for Approach and Landing Test (ALT) flights Captive/Active 1 and Captive/Active 3. The data for this memorandum were drawn from the simulation runs described in reference 1.

2. SYMBOLS

ALT	Approach and Landing Test
C/A	Captive/Active
C/W	Caution and Warning
H ₂	Hydrogen
HPGS	High Pressure Gas Storage
hr	Hour
lb	Pounds
O ₂	Oxygen
OV	Orbiter Vehicle
psia	Pounds per Square Inch Absolute

3. METHOD

Special simulation runs were made using the HPGS program to determine the amount of elapsed time required for primary O₂ and primary H₂ tanks to cross over to the secondary O₂ and H₂ tanks (ref. 1). From these simulation runs, elapsed time to caution and warning pressures and quantities remaining in the primary systems at these pressures were taken.

To determine the required data values, the following assumptions were used in performing the analyses, together with the assumptions and constraints described in reference 1.

O₂ and H₂ caution and warning (C/W) pressures are defined as:

- a. O₂ C/W pressure is 1170 psia.
- b. H₂ C/W pressure is 720 psia.

4. RESULTS

The results for the analyses are presented in table I, which shows the elapsed time from T-0 disconnect to the C/W pressures, the quantity remaining at the C/W pressures, and the elapsed time from C/W to primary/secondary system cross over.

This memorandum fulfills the requirement request made by T. Davies of NASA/EP5.

TABLE I. - CAPTIVE/ACTIVE 1 AND 3 CAUTION AND WARNING DATA

CAPTIVE ACTIVE 1		CAPTIVE ACTIVE 3	
O ₂	H ₂	O ₂	H ₂
Elapsed time to C/W, hr.....	3.3230.....	3.710.....	3.3233.....
Quantity remaining in primary system, lb.....	55.899.....	2.956.....	55.898.....
Elapsed time from C/W to primary/secondary crossover, hr.....	1.530.....	1.490.....	1.526.....
			1.489

5. REFERENCES

1. Hurst, J.E.: Captive Active 1 and 3 Energy Requirements for Primary/secondary Crossover, AMD 037, Lockheed Electronics Company, Inc., March 15, 1977.